

# MONTHLY WEATHER REVIEW,

## MARCH, 1878.

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

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### INTRODUCTION.

In compiling the present Review the following data, received up to April 13th, have been made use of, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at one hundred and thirty Signal Service stations and twelve Canadian stations; monthly journals and means from one hundred and thirty-four of former, and means from twelve of latter; two hundred and forty-three monthly registers from Volunteer Observers; forty-seven monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports of the Weather Services of the States of Iowa and Missouri; reliable newspaper extracts; special reports.

### BAROMETRIC PRESSURE.

Upon chart No. II is shown the general distribution of the atmospheric pressure by the isobaric lines. Compared with the means for March of previous years the pressure for the present month averages lower than usual, except for the California coast, where it has been about the normal. From the Missouri valley to the Upper Lakes it is lower from 0.15 to 0.25 of an inch; in Nova Scotia from 0.10 to 0.15 of an inch.

*The local barometric ranges*, as reduced to sea-level, for the month, have been as follows: *Large*—Springfield, Mass., 1.64 in.; Portland, Me., 1.58; Mt. Washington, 1.55; Boston, 1.53; Albany, New Haven and Wood's Holl, 1.49; New London and Eastport, 1.48; Newport, 1.46; Burlington, 1.44; New York, 1.41; Philadelphia, 1.36, and Rochester, 1.33 in. *Small*—San Diego, 0.52 in.; Los Angeles and Key West, 0.55; Yuma, 0.65; Santa Fe, 0.66; Brownsville, Tex., 0.68; Mobile, 0.70; New Orleans, Vicksburg and St. Marks, 0.73; San Francisco, Pioche, Montgomery and Galveston, 0.75; and Visalia, Indianola, Nashville and Jacksonville, 0.76 in.

*Areas of High Pressure.*—Ten of these have appeared and are described. While the number is about the average for the month, yet none of them were very decided, as is usual for the month of March. There have not been any general "northers" in the Gulf States during the month.

No. I.—This is a continuation of the high pressure area described in the February Review as No. X. 1st, in the morning it was central north of New York; highest barometer, reduced to sea-level, 30.69 in. at Rockliffe, Canada, and 0.65 in. above the normal at Father Point; the temperature was below zero in the Ottawa and St. Lawrence valleys, minimum  $-12^{\circ}$  at Rockliffe, and below freezing from New England to the Lakes and interior of the Middle States and North Carolina. 2nd, it was highest in the morning in southern New England, with the barometer 30.43 at New London, and 0.41 above the normal at Boston and New London; temperature below freezing from northern Michigan to New England, and below zero over the mouth of the St. Lawrence. During the day it disappeared in advance of storm No. I.

No. II.—1st, the pressure increased along the entire Pacific coast, with clear weather, the barometer at San Francisco reading 0.30 above the normal by midnight. 2d, it continued advancing eastward across the Rocky Mountain region, producing high northerly winds and gales from Dakota to northern Texas; N. 56 miles on Pike's Peak; midnight barometer at Salt Lake City 0.49 above normal; morning minimum temperature on Pike's Peak,  $-10^{\circ}$ . 3rd, it extended toward the Lower Missouri valley and the Southwest, with colder and clear weather; barometer 0.30 above normal at Denver and North Platte in the afternoon. 4th, in the morning it was central in Texas and Indian Territory, with barometer 0.23 above normal at Fort Sill and Denison. 5th, morning, it covered the South Atlantic States, with cold and clear weather; temperature below freezing from northern Georgia and eastern Tennessee to New England; at Wilmington, mid-

night barometer 0.45 above normal. 6th, isobar 30.40 included the South Atlantic States and portions of Nova Scotia and New Brunswick, and 0.51 above normal at Halifax. In the first section it continued above the normal during this day and the following, while storm No. III was passing eastward. 8th, it apparently extended itself northward, with increasing pressure, over the Middle States; midnight, above normal 0.40 at Cape May, 0.44 at Burlington and 0.49 at Kingston. 9th, isobar 30.50 reached from New Jersey to the St. Lawrence valley; 0.58 above normal at Burlington and 0.68 at Farther Point. It passed to the southeastward during the 9th and 10th, in advance of storm No. V.

No. III.—During the 7th this high area advanced eastward over the Pacific States, especially Oregon, following storm No. III. 8th, morning, the barometer at Portland read 30.50, or 0.44 above the normal; by midnight 0.39 above at Virginia City. 9th, it apparently passed northward into British America.

No. IV—was first felt on the 10th as advancing southeastward over the St. Lawrence valley. 11th, morning, barometer at Father Point 0.72 above normal. 12th, isobar 30.40 included New Brunswick, with temperatures slightly above zero. During the 12th and 13th it disappeared to the eastward in advance of storms Nos. VII and VIII.

No. V—apparently advanced southeastward over the Rocky Mountain region on the 13th. 14th, morning, barometer at North Platte 0.21 above normal, and, midnight, 0.23 above at Santa Fe; afternoon it was central in Missouri. 15th, morning, central in the lower Ohio valley, with increased pressure; midnight, it covered the Southern States, and afterward rapidly lost its identity under the influence of storm No. IX, then advancing southeastward over the Lake region.

No. VI.—16th, morning, barometers at Virginia City 0.28 and North Platte 0.35 above the normals; the central highest pressure passed eastward over Manitoba; afternoon, barometer at Bismarck 0.36 above normal. 17th, it appeared as a barometric ridge, reaching from Minnesota to Nebraska, which gradually moved eastward. 18th, morning, isobar 30.20 included the country from Michigan to northern Mississippi and northeastern Arkansas, and 0.32 above normal at Milwaukee. 19th, morning, it was central in Tennessee, and only 0.19 above normal at Nashville. It was dissipated in the Southern States on that and the following day.

No. VII.—19th, advanced southeastward over Manitoba; barometer 30.40 at Ft. Garry. 20th, it covered the Upper Lake region; morning barometer at Milwaukee 30.33, or 0.34 above normal; only a slight fall in temperature accompanied it. 21st, isobar 30.20 reached from Virginia northward over Lake Ontario into Quebec, and the following morning included the Lake region and Middle States, with minimum temperatures of near zero in the Lower St. Lawrence valley and New Brunswick. During the day it rapidly disappeared under the influence of storms Nos. XI and XIII.

No. VIII.—23d, morning, barometer at Virginia City 0.30 above normal. 24th, it passed eastward over Manitoba, with a decided fall in the temperature from the Northwest to the Lakes; morning maximum barometer 30.40 at Fort Garry. 25th, the highest was central in the Lower Ohio valley, with freezing temperatures in the morning from Virginia and eastern Tennessee northward. 26th, morning, highest barometer 30.18 at Norfolk, and then passed eastward in advance of storm No. XIV. It was this high pressure-area, in connection with storm No. XV, that caused the sudden fall in temperature nights of the 24th and 25th, and consequent injury to fruits and tender vegetables as far south as Virginia.

No. IX—advanced southeastward from Manitoba the 27th toward the Northwest. At Fort Garry, highest barometer 30.27 morning of the 28th, and only 0.14 above the normal at Pembina; 29th, highest over the Upper Lakes; 30th, morning, with increased pressure, it was central north of New York; barometer 30.37 at Rockliffe, and 0.33 above normal at Burlington. Thence it took a northeastward course, owing to the very low pressure-area prevailing on the coast of Nova Scotia.

No. X.—The month closed with a high pressure existing over the country from Oregon to Dakota and Nebraska. 31st, afternoon, barometer at Portland, Or., 0.34, and midnight at North Platte 0.26, above normals.

*Areas of Low Pressure.*—Of these seventeen have been traced, as shown upon chart No. I. The most severe were Nos. I, III, V, IX, X, XIII, XV, XVI, and XVII. The terrific snow-storm produced by No. III, from the 7th to the 11th, in Colorado, Wyoming and western portions of Nebraska and Dakota will always be remembered by those who experienced it. Nos. IX, X and XVI produced heavy easterly gales, shifting to northwesterly, along the Atlantic coast from North Carolina northward, and Nos. I, XV and XVII southerly veering to northwesterly gales.

No. I.—This is a continuation of the low pressure area described in the February REVIEW as No. XIII. 1st, at 7:35 a. m., it was central in northwestern Texas, with low barometer from Texas to Dakota; 0.45 below the normal at Fort Sill. By midnight it had moved to eastern Kansas, with diminished central pressure; 0.45 below normal at Leavenworth. During the day high winds, gales, and rain prevailed from the Southwest to the Northwest, partly as snow from Colorado to Dakota, with thunderstorms in Kansas, Arkansas, and western Tennessee. At Creswell, Kan., there was a furious hail, heavy rain and thunder-storm, and the streams rose five feet within three hours. 2nd, the rain-area extended to the Lakes, New England, Middle States and East Gulf States, with frequent high winds and gales, while clearing weather followed from the Missouri valley to the Gulf States. Thunder-storms occurred from Georgia to Illinois, Indiana and Ohio; tornado in Casey county, Kentucky; on Mt. Washington heavy snow fell, with a west wind of hurricane velocity. A. m., minimum barometer 29.31 at Keokuk, or 0.66 below normal.

3rd, a. m., minimum barometer 29.24 at Port Huron, or 0.72 below normal; midnight, barometer 29.17 at Eastport, and 0.75 below normal at Boston. The rain-area continued moving eastward, but generally turning into light snow in the Lake region and St. Lawrence valley, with thunder-storms in Florida and from Maryland to Massachusetts. Clearing weather extended over the Upper Lake region, Southern and Middle Atlantic States. 4th, a. m., barometer 29.08 at Eastport, or 0.84 below normal; p. m., 29.04 at Sydney, or 0.85 below. It disappeared eastward toward Newfoundland, followed by high northwesterly winds and gales from North Carolina northeastward. During its progress the following maximum hourly velocities were recorded, viz: Pike's Peak, N. 50; Camp Stockton, W. 40; North Platte, NW. 66; Cairo, SW. 42; Grand Haven, N. 36; Cleveland, SE. 38; Punta Rassa, NW. 48; Cape Henry, NW. 43; Sandy Hook, S. 36 and NW. 44; Wood's Holl, SE. 45; Thatcher's Island, S. 32 and NW. 36; and Mt. Washington, W. 96 miles. Cautionary Signals were displayed on Lake Michigan, and at the Atlantic and Gulf coast stations, excepting Florida. All were justified, except along the Gulf coast, yet the brig "Ransom" encountered very heavy seas and heavy S. gales in the Gulf on the 3rd, and heavy NW. gales on the 4th. At some distance off the Atlantic coast vessels report having experienced SW. gales, at times hurricane squalls, with tremendous sea, on the 3rd, and violent NW. gales on the 4th.

No. II.—2nd, the pressure began diminishing along the Pacific coast. 3rd, rainy weather prevailed from the northern half of California to Washington Territory, with high southerly winds and gales; p. m. barometer at Portland 29.69, or 0.34 below normal. 4th, morning, it was probably central in Montana, where light rains fell, with rapidly falling barometer thence toward the Northwest; midnight, it appeared as a barometric trough, reaching from New Mexico to eastern Dakota, with barometer lowest at Pembina, 29.44, or 0.60 below normal. 5th, it disappeared north of the Upper Lakes without any precipitation east of Montana; a. m. Pembina barometer 0.69 below normal. Maximum hourly velocities—Portland, Or., S. 36; Pike's Peak, SW. 64; Dodge City, SW. 44; Chicago, S. 35; and St. Louis, S. 38 miles. The Signals ordered for Lake Michigan, morning of the 5th, were rather late.

No. III.—5th, this storm passed over Washington Territory and Oregon at night, accompanied by high southerly winds and heavy rains; barometer 0.40 below normal at Portland. 6th, it extended to Idaho, Nevada and California. 7th, it turned into a heavy and very severe snow-storm from eastern Nevada to Colorado and Wyoming, with winds shifting to cold northerly; p. m. barometer at Denver 0.54, and midnight at North Platte 0.71, below the normals. The barometer rapidly fell from the Southwest to the Northwest, producing a steep barometric gradient and frequently brisk and high southerly to easterly winds. 8th, the severe snow-storm continued from Colorado to western Dakota, with cold northerly gales; falling and low barometer, high southerly to easterly winds and gales, and frequent rains from the Southwest to the Northwest and Lake Superior, with frequent thunder-storms; a. m. barometer at North Platte 0.70, p. m. at Dodge City 0.68, and midnight at Omaha 0.55, below the normals; during the evening, the winds in western portions of Nebraska and Kansas, shifted to cold, northerly gales. 9th, the snow-storm ceased in Colorado, but continued from eastern Wyoming to western Dakota; high southeast to northeast winds and gales and rainy weather from Missouri to Wisconsin, Minnesota and Eastern Dakota; colder, clearing weather and northwesterly gales from western Nebraska to northern Texas. 10th, it moved northwestward, with increased central pressure; easterly gales prevailed from northern Wisconsin to northern Dakota; probably united with a second depression which advanced southeastward over Dakota; p. m. barometer 0.59 below normal at Bismarck. 11th, remained almost stationary in southeastern Dakota. 12th, united with No. VII. 13th, gradually disappeared in southeastern Minnesota. Quite a number of lives are reported to have been lost in this snow-storm, also, herds of sheep. Cautionary Signals were ordered for Lake Michigan evening of the 7th and justified. Maximum hourly velocities—Red Bluff, SE. 33; Salt Lake City and Pioche, NW. 32; Santa Fe and Fort Sill, W. 40; Stockton, Texas, NW. 44; Pike's Peak, NW. 92; Cheyenne, N. 64; North Platte, SE. 44 and NW. 60; Dodge City, SW. 60; St. Louis, SE. 40; Duluth, NE. 62; Breckenridge, E. 43, and Bismarck, NE. 48 miles.

No. IV.—6th, frequent light rains fell from the Upper Mississippi valley to the Lakes, with brisk and occasionally high southerly veering to westerly winds, and with thunder-storms from eastern Missouri to Wisconsin, Michigan and Indiana. 7th, the central depression passed over northern New England, with frequent light showers from the Lower Lakes and Middle States eastward, and with thunder-storms from New Jersey and eastern Pennsylvania to Connecticut and Rhode Island. On Mt. Washington a hurricane of NW. 138 miles prevailed during the evening. Of the Cautionary Signals displayed at Kittyhawk, Cape Henry, Cape May and Sandy Hook, the two former were not, and the two latter were, justified.

No. V.—8th, developed from No. III in Texas, in the eastern half of which rain accompanied thunder storms, with increasing southeasterly winds. 9th, thunder-storms, very heavy rains, and gales occurred from eastern Texas to Arkansas, Mississippi and western Tennessee; over four inches of rain fell at Shreveport, Vicksburg and Little Rock, and a reported fall of over twelve inches at Okalooska, Ouachita Co., La., within sixteen hours, flooding the surrounding country. 10th, it was gradually dissipated in northern Georgia, after having produced southerly gales and thunder-storms in Florida, Alabama and Georgia, and a tornado at Atlanta, Ga. Signals displayed the 8th from Indianola to New Orleans, the 9th from Mobile to Key West and Cape Hatteras, were all justified except at Key West. Maximum hourly velocities—Galveston, N. 46; Mobile, SE. 48; Montgomery, SE. 36; Jacksonville, SE. 30; and Charleston, SE. 35 miles.

No. VI.—9th, during the night the barometer rapidly fell in the St. Lawrence valley. 10th, very light snow and rain was reported thence to Nova Scotia, with southerly veering to northwesterly winds, which,

with high cross-seas; 48° 07' N., 36° 05' W., heavy SW. gale, backing to NW., lasting 48 hours. 28th, w'ly gales in 48° 39' N., 34° 31' W.; 48° 13' N., 37° 24' W., with high sea; 49° 41' N., 29° 03' W., with heavy squalls and high sea; and 50° 40' N., 37° 16' W. March 1st, 46° 34' N., 43° 07' W., fresh NW. gale, with high W. sea; 51° 01' N., 10° 41' W., WSW. moderate gale, squally, high head-sea; 49° 20' N., 25° 18' W., high sea. 2nd, 48° 12' N., 40° 36' W., SW. to NW. storm, heavy squalls and high sea; 42° 49' N., 42° 31' W., 11 a. m., N. gale, with hail, snow and heavy sea. 3rd, 43° 40' N., 47° 40' W., midnight of 3rd, violent gale and thick snow-storm; 46° 49' N., 44° 22' W., NW. storm; 50° 23' N., 24° 26' W., SW. to WNW. fresh to moderate gale, with high sea; 48° 47' N., 32° 15' W., SSW. and WNW. very severe hurricane-like gale, high irregular sea, decks under water; 49° 43' N., 10° 28' W., high sea from WSW.; 50° 27' N., 24° 59' W., WNW. strong wind and high sea; 47° 37' N., 32° 10' W., WNW. strong gale, high sea, sleet and hail; 40° N., 31° W., strong WNW. gale. 4th, 42° 09' N., 60° 09' W., S. and SW. strong gale, high SW. sea; 49° 04' N., 28° 50' W., WNW. fresh gale, high sea; 47° 56' N., 37° 15' W., WNW. severe gale, high sea; 49° 21' N., 28° 34' W., WNW. strong wind, high sea; 46° 42' N., 34° 37' W., WNW. fresh gale, very high, confused sea; 51° 33' N., 18° 03' W., W. fresh gale, lasting 12 hours. 5th, 44° 52' N., 55° 41' W., WSW. storm, dense fog; 48° 30' N., 33° 23' W., WSW. moderate gale; 47° 44' N., 33° 41' W., W. by N. fresh gale, high sea; 46° 52' N., 42° 28' W., WSW. severe gale, very high sea; 48° 11' N., 32° 40' W., WSW. fresh breeze, high sea; 51° 02' N., 19° 24' W., WNW. strong gale and squalls; 45° 58' N., 37° 50' W., high sea; 50° 55' N., 23° 18' W., fresh gale and high seas. 6th, 45° 16' N., 48° 53' W., strong SW. gale; 53° 13' N., 24° 52' W., WNW. strong breeze and high sea. 7th, 44° 24' N., 45° 38' W., moderate SW. gale; 48° 42' N., 34° 21' W., high SW. sea; 54° N., 4° E., heavy storm. 9th, 45° 26' N.; 46° 33' W., high sea from W. 11th, 42° 26' N., 55° 35' W., strong NW. breeze, with heavy squalls; 45° 23' N., 43° 10' W., fresh gale. 12th, 46° 49' N., 39° 58' W., strong gale, very high sea; 47° 48' N., 41° 08' W., SW. moderate gale, high sea; 44° 44' N., 46° 35' W., SW. and NW. fresh gale and snow squalls; 42° 05' N., 54° 56' W., NNW. stormy, heavy squalls; 44° 00' N., 47° 15' W. NW. heavy gale, high sea, snow and hail; 45° 35' N., 45° 16' W., heavy NW. gale; 44° 50' N., 45° 00' W., heavy WNW. gale, very high sea; off North Foreland, 53° N., heavy NW. gales; 48° 59' N., 45° 13' W., 4:10 p. m. Greenwich time, bar. 28.76, terrible cyclone struck, blowing with great violence from N. to NNW., till 3 p. m. 13th, tremendous sea. 13th, 45° 24' N., 42° 13' W., strong NW. gale, with very high sea; 46° 10' N., 44° 52' W., fierce WNW. gale, high sea; 40° 51' N., 63° 20' W., high N. sea; 42° 43' N., 50° 34' W., NW. gale; 50° 11' N., 27° 30' W., high southerly sea; 44° 28' N., 46° 08' W., heavy gale. 14th, 46° 59' N., 35° 28' W., WNW. stormy, high sea; 48° 38' N., 33° 14' W., high westerly sea. 15th, 45° 18' N., 41° 39' W., high W. sea; 46° 52' N., 39° 02' W., high SW. sea. 16th, 43° 59' N., 46° 53' W., SW. stormy, high sea; 44° 47' N., 44° 52' W., high SW. sea; 23° N., 67° W., ENE. gale. 18th, 49° 30' N., 24° W., terrific gale from S. round to NNW. 19th, 45° 11' N., 42° 24' W. NW. SW., fresh breeze with squalls ending with gale; 51° 25' N., 26° 05' W., gale. 20th, 42° 13' N., 59° 02' W., SE. to W. fresh gale and high sea; 43° 50' N., 48° 27' W., S. to W. strong breeze to fresh gale; 43° 7' N., 48° 19' W., south-westerly gale, confused sea; 47° 49' N., 34° 11' N., NNW. stormy, high sea. 21st, 42° 23' N., 54° 32' W., SE. and NW. strong winds and squalls; 44° 55' N., 44° 50' W., variable fresh gales and squally; 46° 21' N., 41° 41' W., high sea and heavy rain. 22nd, 41° 25' N., 59° 18' W., WNW. gale; 45° 37' N., 42° 36' W., SE. and W. strong gales, hard squalls, high sea; 43° 46' N., 48° 26' W., W. fresh gale, hard squalls; 45° 00' N., 43° 28' W., SE. and W. strong gale, high E. sea; 41° 12' N., 61° W., gale. 24th, 47° 48' N., 40° 12' W., SW. to WNW. moderate to strong gale, high sea; 42° 11' N., 59° 46' W., W. and SSW. very stormy; Moville Roads, N. of Ireland, NE. gale. 55° 22' N., 9° 05' W., N. hard gale, snow squalls, high sea. 29th, 51° 03' N., 16° 05' W., NNE. fresh gale, squally, heavy sea.

## TEMPERATURE OF THE AIR.

The isothermal lines upon chart No. II illustrate the general distribution of the temperature of the air for the month. Without a single exception, the average is above that for years in every district, and especially so from the Missouri valley to the Upper Lake region, as will be seen by a reference to the table in the left-hand corner of the same chart. For the past four months the temperature has averaged very high over this same area, and more so for December and March than for January and February.

*Minimum and Maximum Temperatures* respectively are—in Maine, at Orono, 8° and 56°; Eastport, 9°, 53°. New Hampshire, Mt. Washington, —18°, 35°; Auburn, 12°, 64°. Vermont, Woodstock, 1°, 63°; West Charlotte, 12°, 66°. Massachusetts, Rowe, 4°, 52°; Boston, 10°, 71°. Rhode Island, Chepachet, 10°, 60°; Newport, 15°, 63°. Connecticut, Southington, 12°, 71°; New Haven, 17°, 65°. New York, North Argyle, 5°, 59°; Starkey, 10°, 80°; Nile, 6°, 72°. New Jersey, Atlantic City, 10°, 63°; Atco, 20°, 73°. Pennsylvania, Blooming Grove, 10°, 70°; Pittsburg, 16°, 74°; Cannonsburg, 18°, 78°. Delaware, Dover, 22°, 68°; Milford, 22°, 73°. Maryland, New Market, 16°, 76°; St. Inigoes, 32°, 72°. District of Columbia, Washington, 21°, 73°. Virginia, Ft. Whipple, 20°, 72°; Alto Vista, 25°, 78°; Prospect Hill, 29°, 77°. West Virginia, Helvetia, 18°, 72°; Morgantown, 18°, 75°. North Carolina, Highlands, 23°, 65°; Goldsboro, 33°, 82°; Wilmington, 34°, 84°. South Carolina, Spartanburg, 27°, 79°; Charleston, 41°, 83°. Georgia, Gainesville, 32°, 82°; Quitman, 34°, 85°. Florida, Daytona, 33°, 88°; Jacksonville, 39°, 86°; Key West, 39°, 87°. Alabama, Green Spring, 28°, 81°; Montgomery, 37°, 83°; Mobile, 42°, 83°. Mississippi, Fayette, 38°, 81°; Vicksburg, 43°, 85°. Louisiana, Oskalooska, 33°, 88°; Shreveport, 45°, 87°. Texas, Uvalde, 32°, 87°; Laredo, 44°, 90°; Brownsville, 41°, 88°. Indian Territory, Ft. Sill, 24°, 85°; Ft. Gibson, 29°, 81°. Arkansas, Mt. Ida, 32°, 84°; Judsonia, 37°, 85°. Tennessee, Knoxville,